

How Windmills Work

Most modern windmills (some people call them wind turbines by the way) have three blades. A number of variations have been tried, two blades, even one blade – but three blades works the best, and it's won the evolutionary battle so to speak.

And most modern windmills rotate clockwise. We don't think there's any particular reason for that and there have been some that rotate the other way. But if you see a windmill in Britain and it's rotating anti clockwise – you're looking at it from behind.

Windmills are computer controlled. One of the main jobs is to keep the windmill facing the wind. To do this the computer monitors the direction and speed of the wind using instruments on top of the windmill. With this data the 'hub' of the windmill (the bit the three blades are attached to) is kept turned so that the blades are always facing into the wind. And the blades themselves are pitched (twisted) to either be catching the wind – or shedding it, if the circumstances require it.

Windmills might shed the wind in a gale for example (when there's too much energy in the wind) or if there was a fault with the grid or the windmill itself.

The blades of a windmill are aerodynamically optimised to make the most of the energy in the wind and turn it into rotational energy – making the blades spin round.

These blades are connected to a generator, sometimes through a gearbox (in what's known as 'fixed speed' machines) and sometimes connected directly (in what are known as 'variable speed' or 'direct drive' machines) – in both cases the generator converts the mechanical energy – the rotation of the blades – into electrical energy. Green electricity of course.

Fixed speed machines run at one speed of rotation, whatever the wind speed. While variable speed machines speed up and down as the wind speeds up and down – which it does all the time.

Fixed speed windmills use a gearbox to create electricity at the right frequency for the grid, 50Hz for the UK. Variable speed machines use electronics to do the same job – we sometimes think of this as an electronic gearbox.

In both cases, once the electricity is made, and made suitable to enter the local grid, that's where we send it - via underground cables. From where it can be used to power your home, or someone else's.

The energy payback of a modern windmill (the time it takes to get back the energy used to manufacture and install each windmill) is between 6 and 9 months – depending on location (some places are more windy than others). After that, for perhaps another 20 to 25 years, windmills bring a big net gain of clean energy and avoided carbon emissions.